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## SOLAR OBSERVATIONS

## SOLAR AND SKY RADIATION MEASUREMENTS DURING SEPTEMBER, 1927

By HERBERT H. KIMNALL, Solar Radiation Investigations

For a description of instruments and exposures and an account of the method of obtaining and reducing the measurements, the reader is referred to the REVIEW for January, 1924, 52: 42, January, 1925, 53: 29, and July, 1925, 53: 318.

Table 1 shows that solar radiation intensities were above the normal values for September at Washington, D. C., and Madison, Wis., and close to normal at Lincoln, Nebr. At the latter station a noon intensity on the 20th of 1.48 gram-calories per minute  $\text{cm}^2$  equals the previous maximum intensity obtained at that station in September.

Table 2 shows an excess at Washington and Lincoln in the total solar radiation received on a horizontal surface directly from the sun and diffusely from the sky, and a deficiency at Madison, as compared with the September normals for these stations.

Skylight polarization measurements at Washington made on six days give a mean of 53 per cent, with a maximum of 60 per cent on the 12th. At Madison measurements on three days give a mean of 69 per cent with a maximum of 73 per cent on the 23d. These are close to normal values for September at Madison and considerably below at Washington.

TABLE 1.—*Solar radiation intensities during September, 1927*

[Gram-calories per minute per square centimeter of normal surface]

## Washington, D. C.

Date	Sun's zenith distance									
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°
	75th mer. time	Air mass								
e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
Sept. 6.....	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.
Sept. 6.....	11.81	0.80	0.84	0.96	1.10	1.27	1.00	0.87	0.74	10.21
Sept. 12.....	9.83	0.87	0.94	1.00	1.20	1.47	1.20	1.05	0.93	9.14
Sept. 20.....	8.48	0.69	0.82	1.00	1.15	1.37	—	—	—	7.04
Sept. 22.....	6.50	—	—	—	—	—	—	—	—	7.29
Sept. 23.....	6.76	—	—	—	—	—	—	—	—	5.56
Sept. 24.....	7.29	—	—	—	—	—	—	—	—	5.79
Sept. 27.....	10.21	—	—	—	—	—	—	—	—	10.97
Means.....	0.79	0.84	0.94	1.13	1.37	(1.10)	(0.96)	(0.84)	(0.86)	—
Departures....	+0.09	+0.09	+0.07	+0.09	+0.05	+0.05	+0.11	+0.11	+0.19	—

## Madison, Wis.

Sept. 3.....	11.38	—	—	1.10	1.25	1.45	—	—	—	9.47
Sept. 14.....	16.20	—	—	—	—	—	—	—	—	16.20
Sept. 19.....	5.36	—	—	1.12	1.30	—	—	—	—	4.95
Sept. 21.....	6.27	—	—	1.14	—	—	—	—	—	6.50
Sept. 23.....	6.02	—	—	—	1.20	—	1.25	1.06	—	6.27
Means.....	—	—	—	1.12	1.19	(1.45)	(1.25)	(1.06)	—	—
Departures....	—	—	—	+0.09	+0.02	+0.07	+0.09	+0.05	—	—

TABLE 1.—*Solar radiation intensities during September, 1927*—Con.

Lincoln, Nebr.

Date	Sun's zenith distance										Local mean solar
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	
	75th mer. time	Air mass									
e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.	
Sept. 2.....	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.
Sept. 3.....	16.20	—	—	—	—	—	—	—	—	—	12.24
Sept. 4.....	15.65	—	—	—	—	—	—	—	—	—	12.24
Sept. 5.....	16.79	—	—	—	—	—	—	—	—	—	15.65
Sept. 8.....	17.37	—	—	—	—	—	—	—	—	—	17.98
Sept. 9.....	17.37	—	—	—	—	—	—	—	—	—	16.70
Sept. 10.....	15.11	0.65	1.77	0.92	1.12	1.32	1.11	0.95	0.82	0.68	14.10
Sept. 12.....	14.10	—	—	—	—	—	—	—	—	—	13.13
Sept. 13.....	15.65	—	—	—	—	—	—	—	—	—	14.10
Sept. 14.....	15.11	—	—	—	—	—	—	—	—	—	16.20
Sept. 16.....	18.59	—	—	—	—	—	—	—	—	—	17.37
Sept. 17.....	16.20	—	—	—	—	—	—	—	—	—	14.10
Sept. 20.....	4.95	—	—	—	—	—	—	—	—	—	3.83
Sept. 21.....	4.95	—	—	—	—	—	—	—	—	—	3.81
Sept. 22.....	5.79	—	—	—	—	—	—	—	—	—	5.16
Sept. 23.....	6.76	—	—	—	—	—	—	—	—	—	6.50
Means.....	(0.65)	0.87	0.99	1.21	1.39	1.66	1.16	0.97	0.82	0.74	—
Departures....	-0.10	+0.00	-0.02	+0.02	+0.01	+0.01	-0.01	-0.01	+0.01	+0.01	—

\*Extrapolated.

TABLE 2.—*Solar and sky radiation received on a horizontal surface*

[Gram-calories per square centimeter of horizontal surface]

Week beginning	Average daily radiation						Average daily departure from normal	
	Wash- ington	Mad- ison	Lin- coln	Chi- cago	New York	Twin Falls		
1927								
Sept. 3.....	cal.	cal.	cal.	cal.	cal.	cal.	cal.	
Sept. 10.....	400	346	470	347	390	499	+15	
Sept. 17.....	362	351	458	328	322	484	-11	
Sept. 24.....	367	356	480	273	276	503	+12	
Deficiency since first of year on Sept. 30.....	—	—	—	—	—	328	+27	
							-150	
							-182	
							-8,484	
							-4,361	
							-7,049	

## POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. C. S. Freeman, Superintendent U. S. Naval Observatory]  
[Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, and Mount Wilson observatories]

Date	Eastern standard civil time	Heliographic		Area <sup>1</sup>	
		Longitude	Latitude	Spot	Group
1927					
Sept. 1 (Yerkes).....	9 59	—	—	—	—
		—53.0	—18.0	200	—
		—45.0	—12.0	150	—
		—10.0	—15.0	—	100
		+48.0	—16.0	100	—
		+53.0	—17.0	100	—
		—38.0	—16.5	—	108
		—31.5	—14.5	—	93
		+3.5	—17.0	—	123
		+67.0	—17.5	—	278
Sept. 2 (Naval Observatory).....	11 31	—	—	—	—
		—25.0	—16.5	108	—
		—17.5	—14.5	77	—
		+16.0	—17.5	—	123
Sept. 3 (Naval Observatory).....	11 38	—	—	—	—
		—25.0	—16.5	108	—
		—17.5	—14.5	77	—
		+16.0	—17.5	—	123

<sup>1</sup> Areas are corrected for foreshortening and are expressed in millionths of Sun's visible hemisphere.